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ABSTRACT

This study was designed to test the validity of using creativity and academic motivation variables, in addition to the traditional variables of scholastic aptitude and high school GPA, as predictors of college GPA. The sample consisted of the 1973-74 freshman class at the College of Basic Studies (CBS) at Boston University; CBS is a two-year college designed for educationally marginal students. The predictor variables included: (1) personality measures from the Test of Effective Academic Motivation (TEAM); (2) overall measures of fluency, flexibility, and originality from selected items of the Torrance Tests of Creative Thinking; (3) verbal and numerical SAT scores; (4) high school GPA; and (5) sex. The criterion variable was overall freshman GPA based on five CBS "core" courses. The TEAM test was administered to all freshman students upon college entrance. The Torrance Tests were given to all freshman students who were present at a required psychology lecture class during the first part of the fall semester; 54 percent of the freshman class was present. Results confirmed that SAT and GPA factors were strong and stable predictors of freshman GPA while Creativity was a stable, but very weak, third predictor. TEAM factors were poor and unstable predictors. (Author/DC)

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CREATIVITY AND ACADEMIC MOTIVATION VARIABLES AS PREDICTORS OF ACHIEVEMENT IN A TWO-YEAR COLLEGE FOR EDUCATIONALLY MARGINAL STUDENTS[1]

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This study addresses the contribution of creativity and academic motivation variables in addition to more traditional variables such as academic aptitude scores and high school grades, in predicting for freshman grade point average (GPA) in a two-year college for educationally marginal students.

The sample was taken from the 1973-74 freshman class at the College of Basic Studies (CBS) at Boston University. CBS has been highly successful in both the number of students who transfer to four-year programs and in subsequent academic performance (Fogg, 1971; Smith, 1972). The CBS program derives from the "cluster college" model, incorporating team teaching, a core curriculum, extensive guidance counseling, and a highly student-centered program. The CBS program and goals are described further in Smith (1972). The program has been presented as a model for colleges wishing to provide a compensatory program for marginally qualified high school students (Mosteller and Moynihan, 1972). Several schools have adopted similar programs, and CBS has received numerous inquiries about the CBS model (Fogg, 1974).

Scholastic aptitude and high school achievement measures have been widely demonstrated to be successful predictors of college grade point average (GPA) at both the two-year and four-year college level (Cohen and Brawer, 1970; Trent and Medsker, 1968). Fishman (1962) suggests consideration of

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additional predictors which don't correlate with traditional ones. Measures of creative ability address an additional and important ability domain which has been only minimally tapped by intelligence and scholastic aptitude tests; creativity-intelligence correlations average about 0.30 (Guilford, 1967).

There is evidence of the relevance of creative thinking to scholastic achievement in some types of situations. While less dramatic than results with traditional predictors, both positive and negative creativity-achievement relationships have been found in sub-college student populations (Torrance, 1966). In contrast, at the college level, significant creativity-achievement relationships generally tend to be negative (Miller, 1967; Axelrod, 1968). Torrance (1966), summarizing a number of studies, proposed that the relationship of creativity to achievement may be complex, varying as a function of the teaching-learning situation. Furthermore, he suggested that the choice of criterion achievement measure may determine whether creativity or scholastic aptitude measures are more related to school achievement in a given situation, as found, for example, by Bentley (1966). Thus, the predictive power of creativity variables may be situation-dependent in several ways.

There is evidence of the relevance of some personality variables to measures of college achievement. However, these variaoles have generally added little to prediction beyond that achieved with more traditional measures (Fishman, 1962). One might indeed expect some relevant variance to be subsumed by measures related to high school success.

In general, the achieving college student emerges as someone who is hardworking, persistent, and responsible (Sexton, 1965; Smith, 1967; Smith and Fogg, 1970). However, apparent inconsistencies emerge on other variables which include; non-conformity, flexibility, sense of security, and personal adjustment (Axelrod, 1968; Sexton, 1965; Smith, 1967). Perhaps, as suggested with creativity, the predictive power

of some personality variables is situation-specific and might, if identified, add to prediction beyond high school grades and scholastic aptitude scores in certain college environments. Some related results at the College of Basic Studies (Smith and Fogg, 1970; Smith, 1970; Fogg, 1971) suggest this possibility.

The present study looks at creativity measures, personality variables related to academic motivation, and more traditional predictors in the type of college environment represented by the College of Basic Studies.

Methods

The sample in this study consists of 278 subjects from the 1973-74 CBS freshman class. The criterion variable was overall freshman GPA, based on five CBS "core" subjects, taken by all freshmen. Curriculum, instruction, and evaluation procedures are similar across instructors for each subject and the range of grades awarded is broad.

Predictor variables indluded: (a) personality measures from the Test of Effective Academic Motivation (TEAM), (b) overall measures of fluency, flexibility, and originality from activities 1, 3, 5, 6, and 7 of the Torrance Tests of Creative Thinking (Verbal Form A), (c) verbal and numerical SAT scores, (d) high school grade point average, and (e) sex.

The TEAM is a self-report instrument measuring aspects of academic motivation. It is based on a peer rating scale that has yielded good correlations with college GPA (Smith, 1967). The 33 TEAM subscales show test-retest reliabilities of about .6 to .7 (Fogg, 1974). Validity information, including concurrent validity with GPA at several educational levels, and at CBS, is reported in Smith (1967, 1970).

The Torrance Tests of Creative Thinking are scored for fluency, flexibility, and originality, with scores summed across items. Typcial alternate forms reliability figures are in the 80's for the full-test subscales. Diverse validity evidence is given in Torrance (1966).

In the present study, the TEAM was administered to entering freshman students upon entrance in the college. The Torrance

Tests were given to all freshman students who were present in a required psychology lecture period during the first part of the fall semester. Verbal and numerical SAT scores, high school GPA and sex were taken from student records, as were subject area and overall freshman GPA. Data on all measures were available for 54% of the CBS freshman class. The large majority of the remaining students were excluded from the sample because of absence from class during creativity testing.

Data analysis included: (a) preliminary comparison of the present sample with other CBS freshman students on personality, aptitude and achievement variables, using multivariate analysis of variance, (b) examination of relationships between predictors, and redefinition of some predictors using factor analysis, and (c) stepwise multiple regression on freshman GPA.

Results

Preliminary Analyses

Comparison of sample to remaining freshmen. The sample (N=278) was compared to remaining CBS freshmen (N=233) on personality, aptitude and achievement variables using multivariate analysis of variance, in order to determine the equivalence of this sample to the remaining freshmen. Following a significant multivariate F-ratio for equality of mean vectors, univariate analysis of variance on the 33 TEAM variables indicated that the sample of this study was higher than remaining freshmen on conscientiousness ($p < .03$), tendency to obey rules ($p < .02$), and extroversion ($p < .003$). Analysis of variance on verbal and numerical SAT scores, high school GPA, and freshman GPA for first and second semesters gave a significant multivariate F-ratio and significant differences favoring the sample on both first and second semester GPA ($p < .0001$), and on high school GPA ($p < .05$).

Redefinition of variables and predictor interrelationships. Prior to regression analysis, SAT scores, high school GPA, and the three creative ability measures were factor analyzed; three factors with eigenvalues greater than one resulted from a principal components solution and accounted for 86% of the variance. These were rotated to the varimax criterion. Factors showed marked simple

structure and were readily identified with creativity, scholastic aptitude and high school achievement. This reflected the high degree of relationship between the three creativity variables ($\bar{r}$=.82), a moderately high relationship between verbal and numerical SAT scores ($\bar{r}$=.53), and notable low relationships between creativity variables and SAT variables ($\bar{r}$=.11), creativity and high school GPA ($\bar{r}$=.04), and SATs and high school GPA ($\bar{r}$=.02).

In a similar procedure, the 33 TEAM variables gave nine factors with eigenvalues greater than one, accounting for 69% of the variance. A varimax rotation was again performed. The resulting factors, while showing less simple structure than the previous set, could be identified with: Competitiveness/Need for Recognition, Hard-working Nature, Tendency to Follow Rules, Parental Valuing of Education, Intellectual Curiosity, Self-Reliance, Introversion, On-the-Go Nature, and Planfulness.

Relationships between TEAM factors and aptitude/ability factors were examined, as well as relationships between sex and all the above variables. Significant low positive correlations between some of these variables were obtained.[2] In addition, scatterplots were constructed and examined for selected variable pairs. While scatters were typically linear and homoscedastic, SAT-Creativity and freshman GPA-Creativity scatters appeared somewhat heteroscedastic, with the first variable in each case in a necessary but not sufficient predictor relationship to the latter.

Prediction of freshman year GPA

The sample was twice divided randomly into approximate halves for determination and cross-validation of a regression equation on overall freshman GPA, using all predictors. In each case, SAT and High School GPA factors were strong and stable predictors of the

[2]Six of the nine TEAM factors gave low positive correlations with the SAT measure. These TEAM factors were: Competitive/Recognition (.24, $p<.001$); Parental Valuing of Education (.20, $p<.001$); Intellectual Curiosity (.23, $p<.001$); Follows Rules (-.16, $p<.01$); Self-Reliance (.14, $p<.05$); and Introversion (.12, $p<.05$).

Two TEAM factors correlated with high school GPA: Hardworking Nature (.13, $p<.05$) and Self-Reliance (-.12, $p<.05$). No creativity-TEAM correlations reached significance.

Sex correlated at a low positive level with six of the 13 predictors: high school GPA (.29, $p<.0001$); SAT measure (-.14, $p<.14$); Creativity (.13, $p<.05$); On-the-Go (.22, $p<.22$); Follows Rules (.16, $p<.01$); and Planfulness (.17, $p<.05$); indicating that females were somewhat higher than males on all variables except the SAT factor.

criterion while Creativity emerged as a stable third but very weak predictor. TEAM factors were unstable predictors across analyses and produced problems upon cross-validation for both regressions. One of these analyses follows.

A stepwise regression was performed and cross-validated on samples of N=146 and 132, respectively. Predictors with an F-to-enter at the .05 level of significance or better were accepted; the final regression equation included 5 of the 13 predictors, with variables entering as shown in Table 1, below.

Table 1

variable	R	R^2	r (criterion)	b·r	beta	t
SAT	.45	.20	.45	.20	.45	7.01****
High School GPA	.56	.31	.33	.10	.30	4.60***
Competition/Recognition	.58	.34	-.23	.04	-.17	-2.27*
Creativity	.61	.37	.15	.03	.19	2.78**
Introversion	.62	.38	.11	.02	.14	2.01*

* $p < .05$
** $p < .01$
*** $p < .001$
**** $p < .0001$

The SAT factor accounted for most of the explained variance, with High School GPA a second substantial predictor. Creativity, while entering fourth, was the third strongest predictor in the final regression equation, though yielding only a small increase in predictive efficiency. Competition/Recognition and Introversion were fourth and fifth, but accounted for little new variance.

Cross-validation of this equation on the remaining subjects gave a multiple-R of .544, surprisingly less than the cross-validation multiple-R from this equation using only SAT and High School GPA predictors. (.595) Further examination indicated that inclusion of the Creativity factor did not add in the cross-validation, while two TEAM variables, particularly Competition/Recognition, led to the decrease in prediction. Examination of the two subsamples showed some differences in means and in intercorrelations between predictors. Most notably, the SAT and Competitive/Recognition correlations differed significantly between the two groups

(-.09,-.36; $p < .04$). Such collinearity suggests different predictor patterns in the two subsamples and the consequent decrease upon cross-validation.

A stepwise regression was subsequently run for the entire sample, to give a better estimate of significant predictor variables. As in the two previous analyses, SAT, high school GPA and Creativity factors emerged as stable predictors, entering first, second, and third in the regression, and were of similar magnitude to predictors in the earlier analysis. In this case, Introversion again entered, this time fourth and Self-Reliance entered fifth.

A stepwise regression was then run on the entire sample with freshman GPA as the criterion and TEAM variables as predictors, to better understand the relevance of these personality variables to the criterion without the constraint of making a predictive contribution above that of SAT and High School GPA variables. Results are found in Table 2 and indicate some relevance of these (essentially independent) variables to freshman year GPA. While high Intellectual Curiosity, Parents' Valuing of Education and low Competition/Recognition all added significantly to prediction, contributions were not particularly large.

Table 2

variable	R	R^2	r (criterion)	b·r	beta	t
Intellectual Curiosity	.21	.05	.21	.04	.21	3.7***
Parents Value of Educ.	.27	.07	.16	.03	.16	2.7**
Competitive/Recognition	.31	.09	-.16	.03	-.16	-2.7**

** $p < .01$
*** $p < .001$

Discussion

Preliminary Analyses

The sample for this study emerged as more conscientious, more apt to obey rules, more extroverted, and more successful academically than the remaining CBS freshmen. These differences are generally consonant with the way the subsample was determined, where membership was determined largely by presence in class during creativity testing; such differentiating variables may be said to characterize students who are more likely to come to class. Results of this study need to be viewed in light of this sample.

Examination of creativity, SAT, and high school GPA interrelationships, through both raw correlations and factor analysis, indicated the essential independence of these classes of variables for the present population. Somewhat restricted range on SAT and high school GPA variables may partially account for this. Additionally, lack of SAT-high school GPA relationship may relate to the selection procedures for CbS students; many are typically low on one or another of these dimensions, while relatively high on the other. Relative independence of SAT and Creativity variables underlines the importance of the creative ability dimension, not subsumed by traditional scholastic aptitude scores--although scatterplot results suggest a possible necessary but not sufficient predictor relation between them. Such scatters have been reported elsewhere (Guilford, 1967; Holtz, 1973). Some characteristic tapped by scholastic aptitude measures may indeed be prerequisite to creativity, although several artifactual bases for such scatterplots have also been suggested (Holtz, 1973). Additionally, freshmen GPA would appear to be somewhat predictive for creativity in a necessary but not sufficient sense, perhaps through its relationship with SAT measures. Such relationships bear further examination.

The lack of correlation between creativity and high school GPA may indicate a general lack of relevance of creativity to high school achievement or alternatively, but less probably, reflect an

averaging of different Creativity-GPA relationships for different subsamples.

As suggested, some academic motivation factors were related to traditional predictors of college achievement, although at a relatively low level.

Prediction of Freshman GPA

Regression results reconfirm the relevance of scholastic aptitude measures and high school grades to the prediction of college achievement. However, high school achievement is not as predictive for this group as for other populations. This is a notable result for a two-year college which attempts to modify students' past achievement patterns, and results have implications for other colleges based on the CBS model.

In all of the full regressions, creativity was a significant and stable predictor, third in importance following SAT and high school GPA measures. While creativity explained very little variance, the positive nature of the creativity-GPA relationship is nonetheless notable in this setting; creativity-achievement relationships at the college level are typically negative or insignificant (Miller, 1967; Axelrod, 1968). Furthermore, the possible necessary but not sufficient relationship between GPA and creativity, and SAT scores and creativity, suggest a further and different type of relationship which needs to be more completely explored. If creativity were used as a moderator variable, for example, different predictor-criterion patterns might emerge for different subgroups.

In the several regressions, TEAM variables were relatively poor and unstable predictors of GPA when taken with SAT and high school GPA factors, confirming Fishman's (1962) statement that personality variables tend to add little to prediction beyond contributions of traditional measures. When SAT and GPA predictors were eliminated from the regression, TEAM variance normally shared with SAT scores was able to predict for the criterion, although at a somewhat low level. This analysis

nonetheless yielded a better understanding of the relevance to CBS achievement of several non-traditional predictors: Intellectual Curiosity, Parents Valuing of Education, and, in the reverse sense, Competition/Recognition (in a school setting). While the first two predictors have been occasionally reported in the literature (Sexton, 1965), the last predictor is unusual. Results may reflect some slight difference in this particular population and type of college environment.

It is notable that the TEAM, in past studies, has led to higher relationships with college GPA than in the present case (Fogg, 1971; Smith and Fogg, 1970; Smith, 1970). The TEAM, however, was administered for this study at the beginning of the freshman year. In the above studies, the instrument was given further into the academic year. Present results suggest, in this context, that scores on personality variables in the TEAM could in fact change as a result of the CBS experience, with possible increased relationships to GPA. This hypothesis is now being tested on the present sample who were administered the TEAM for a second time during the middle of the second semester, 1974 (Fogg, 1974). Low TEAM prediction in the present study may also relate to differences in the present sample; for example, as a group, the students tested here had much lower verbal and numerical SAT scores than other college samples reported in the literature.

Summary

Generally, results from this study support the relevance of traditional predictors to overall freshman GPA at this two-year college for educationally marginal students, although high school GPA seems less relevant for this sample than for other groups.

Creativity was independent of other significant predictors, including the scholastic aptitude variable, and was a stable third predictor of freshman GPA. It explained, however, little new variance. Academic motivation variables were relatively less stable predictors and contributed little to the regression; a small amount of their predictive variance was already subsumed by the scholastic aptitude measure.

Finally, creativity scatterplot results tentatively suggest that prediction addressing possible interactions might be more successful in incorporating many of these non-traditional variables.

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